

# Sections 3.4-3.5 and Chapter 4

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“In Eastern cultures, it’s just assumed that struggle is a predictable part of the learning process. Everyone is expected to struggle in the process of learning, and so struggling becomes a chance to show that you, the student, have what it takes emotionally to resolve the problem by persisting through that struggle.”

- Alix Stigler, NPR

Consider the following two descriptions for creating a CI for a population proportion  $\pi$ . You should assume that all validity conditions are met and all samples are properly obtained.

- ① A theory based 95% CI based on a sample of size  $n = 200$ .
- ② A theory based 90% CI based on a sample of size  $n = 500$ .

(1) In the long run, which type of CI will succeed in capturing the true value of  $\pi$  a larger proportion of the time?

- A Method 1 since it has a higher confidence level.
- B Method 2 since it is based on a larger sample.
- C Both methods will capture  $\pi$  with about equal probability.
- D You cannot tell.

Representative data collected by child development scientists produced the following 90% CI for the average age (in months) at which children say their first word:

$$10.4 < \mu < 13.8.$$

(2) Which of the following are valid interpretations or true statements about this CI?

- A The sample used had  $\bar{x} = 12.1$  months.
- B About 90% of the children in the sample spoke their first word at an age between 10.4 and 13.8 months.
- C A two sided test of  $H_0 : \mu = 11$  months would yield  $p < 0.1$ .
- D All of the above.
- E A and B but not C.

A random sample of college students was used to estimate the proportion of all college students that own a car. A 99% CI based on this sample is:

$$(0.316, 0.462).$$

**(3)** Which of the following are valid interpretations or true statements about this CI?

- A** A 95% CI based on the same sample would be wider.
- B** A smaller sample (with the same value of  $\hat{p}$ ) would have produced a wider CI.
- C** Doubling the sample size (everything else stays the same) would have cut the margin of error in half.
- D** A and B.
- E** B and C.

On January 29, 2011, visitors to the CNN.com website were invited to answer a poll question. The results are shown below and a 99.9% confidence interval for the population proportion (of “yes” responses) turns out to be (0.4846, 0.495).

(4) What is the best explanation of why this interval is so narrow?

**Are you exercising more in 2011?**

No		51%	49,254
Yes		49%	47,232

Total votes: 96,486  
This is not a scientific poll



- A The sample size is very large.
- B  $\hat{p}$  is very close to  $1/2$ .
- C It was a voluntary response sample.
- D CNN.com is a well respected website.
- E All of the above.

The CNN.com poll gave the 99.9% CI of (0.4846, 0.495). The standardized  $z$ -statistic for testing the null hypothesis that 50% of American adults claim to be exercising more in 2011 turns out to be  $-6.51$ , for a  $p$ -value of  $2.5 \times 10^{-10}$ .

(5) These results are certainly statistically significant. How would you describe the practical value of these results?

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- A They have a high practical value since the  $p$ -value is so low.
- B They have a high practical value since the sample size is so large.
- C They have little or no practical value because  $\hat{p} \approx 0.5$ .
- D None of the above.

The CNN.com poll gave the 99.9% CI (0.4846, 0.495).

(6) Which of the following would be reasons to take the results of this poll with some caution?

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- A It is a voluntary response sample.
- B People sometimes forget or misrepresent the truth.
- C The results may have changed if the order of the answers were reversed.
- D People may have let social or peer pressure alter their response.
- E All but one of A to D.



In a study reported in the Archives of Pediatric and Adolescent Medicine on treating warts, researchers investigated whether liquid nitrogen cryotherapy (“freezing it off”) or common duct tape would be a more effective treatment for kids with warts. The researchers randomly assigned the 51 patients to two treatment groups and found that 22 of 26 patients treated with duct tape saw complete disappearance of their warts, compared to 15 of 25 patients in the cryotherapy group.

(7) What are the observational units?

- A Methods for wart removal.
- B Kids with warts.
- C Warts.
- D Researchers.

For the wart study, where researchers randomly assigned the 51 patients to two treatment groups and found that 22 of 26 patients treated with duct tape saw complete disappearance of their warts, compared to 15 of 25 patients in the cryotherapy group.

(8) What is the explanatory variable?

- A Whether a wart completely disappeared or not.
- B The proportion of kids whose warts completely disappeared.
- C Which treatment (cryotherapy or duct tape) was used on each subject.
- D Whether or not cryotherapy and duct tape are equally effective in removing warts on kids.
- E The percentage of kids whose warts did not disappear.

In a study on treating warts, researchers investigated whether cryotherapy or common duct tape would be a more effective treatment for kids with warts. The 51 patients were randomly assigned to two treatment groups and found that 22 of 26 patients treated with duct tape saw complete disappearance of their warts, compared to 15 of 25 patients using cryotherapy.

(9) Assuming the results were statistically significant ( $p < 0.05$ ), would it be correct to conclude that duct tape caused more warts to disappear than did cryotherapy?

- A No, there could be a confounding variable.
- B No, there is no way that duct tape is better.
- C No, cause-and-effect can only be concluded from observational studies.
- D Yes, the data clearly show an association between the treatment group and the complete disappearance of warts.
- E Yes, this is a randomized experiment.

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**(10)** Was this study double-blind?

- A** No, the kids could tell which treatment group they were in.
- B** Yes, both cryotherapy and duct tape are blind treatments.
- C** Yes, the students were randomly assigned to groups so double-blind is implied.
- D** Yes, the researchers did not know which treatment was being applied.
- E** There is not enough information given to decide.

## Key Terms and Ideas to Understand in Chapters 3 and 4

- Confidence Level
- Confidence Interval
- Center of the confidence interval
- Margin-of-error
- 2SD Method for CIs
- How Sample Size Affects CI Width
- Association
- Cause-and-effect Relationship
- Confounding Variable
- Control Group
- Double-blind
- Experiment and Observational Study
- Explanatory and Response Variables
- Placebo